



Prevention of tuberculosis transmission in the household: An investigation of knowledge, attitudes, and practices in West Halmahera Regency, Indonesia

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Abstract

Introduction: Emphasizing the significance of tuberculosis (TB) in the family environment is crucial due to the high rate of transmission among members of the household. This phenomenon has been proven by molecular epidemiological studies using fingerprint D.N.A. analysis to describe the easy transmission incidents in the family environment. Therefore, this study aimed to determine TB patients' knowledge, attitudes, and practices (KAP) in preventing transmission among family members in West Halmahera Regency, North Maluku Province, Indonesia.

Methods: This study was conducted using a cross-sectional design, including 150 TB patients as respondents selected through a sampling method. A structured questionnaire was used as an interview guide for face-to-face data collection. The analysis was conducted from January to June 2023, and the data obtained were analyzed using descriptive statistics with a frequency distribution table and supplemented by narrative.

Results: The results showed that 91 respondents (60.7%) had a good level of knowledge, 76 (50.7%) had favorable attitudes, and 81 (54.0%) had good practices in prevention of TB transmission. Although KAP was in a good category, there were still 43 respondents (28.7%) with TB patients in other family members.

Conclusions: The data obtained showed a possibility of TB transmission to other family members in the household due to a lack of KAP in prevention. Monitoring and patient access to pulmonary TB drugs was also found to be suboptimal. Consequently, proactive efforts are essential to enhance prevention in families to eliminate TB patients in line with the objectives stated in the national strategy for controlling TB in Indonesia.

Take-home message: A study of KAP in a community is useful for planning, implementing, and evaluating programs to eliminate TB patients. This indicates that KAP level testing can be used to determine follow-up methods for handling TB transmission in the family.

Keywords: incidence of transmission; Knowledge-Attitudes-Practices (KAP); transmission in family; tuberculosis.

INTRODUCTION

The infectious disease pulmonary tuberculosis (TB) is a global health burden with a significantly high incidence rate [1-3]. In Indonesia, the prevalence of this disease is excessively high, ranking second after India with a total of 969,000 cases or 354 per 100,000 population [2,4]. Currently, Indonesia, along with other countries, is also categorized as High Burden Countries for dealing with TB cases, TB with HIV, and Multi-Drug Resistance-TB (MDR-TB) [5,6]. To eliminate TB transmission, the country has developed a community-centered planning and program priority approach, as recommended by WHO. This strategy uses epidemiological evidence, focusing on community characteristics, such as the socio-economic characteristics of patients and family support [7]. Moreover, an essential strategy is to prevent transmission and reduce factors complicating TB infection, such as preventing the occurrence of MDR-TB [1,2].

Several reports showed that TB transmission easily occurred between family members or in the community [8-11]. Similarly, it was reported that, on average, one TB patient can infect 10 to 15 people [12]. This ease of transmission is attributed to TB being airborne and disseminating through droplets containing *Mycobacterium tuberculosis* bacteria. When an individual infected with TB coughs, sneezes, or talks, particles in the form of droplet nuclei can spread in the air and inhaled by those in proximity [13-16], posing a risk for human-to-human transmission. However, the prevention and treatment of this disease become increasingly difficult when transmission occurs from patients who have drug-resistant [17,18].

The management and control of TB face complexity due to the occurrence of drug resistance in patients, known as MDR-TB. This resistance makes the prescribed medication ineffective against *Mycobacterium tuberculosis*, complicating the treatment process. Resistance to TB drugs can occur due to incorrect diagnosis, improper treatment combination, irregular medication, inadequate medication types or dosage, and premature cessation of treatment [19,20]. In the presence of an MDR-TB in the family, other members are at risk of TB transmission and are resistant to drugs. Early diagnosis and immediate treatment of infected family members are essential to inhibit transmission [17].

Studies on knowledge, attitudes, and practices (KAP) in preventing TB transmission in family members are required to inhibit the spread. This is because actions based on KAP significantly contribute to the success of disease eradication, including achieving the End TB program. Consequently, this study aimed to assess KAP regarding the prevention of TB transmission in the family and the occurrence of MDR-TB. The results are expected to provide valuable information to determine the characteristics of the community, serving as a signal to raise awareness about the prevention of TB transmission.

Research about measuring the KAP level of TB patients in the work area of West Halmahera Regency Health Service is still limited, particularly in the Jailolo health center area. Based on annual data (2021-2022), there is a trend towards an increase in the number of pulmonary TB patients in the region. This shows the need for community-based research to determine KAP in preventing TB transmission among family members. Therefore, the data will be useful for developing community-based TB prevention programs, including developing effective health education.

METHODS

Study design and participants

This study was carried out from January to June 2023 using a cross-sectional design in the work area of West Halmahera Regency Health Service, North Maluku Province, Indonesia. Respondents were registered 150 pulmonary TB patients in the West Halmahera Regency area, selected through a total sampling method.

West Halmahera Regency is on Halmahera Island with an area of 1,074 Km², having an estimated population of 137,126 people in 2022, or around 10.42% of the total population in North Maluku Province. Geographically, West Halmahera Regency is between 10°N-30°N and 1250°E-1280°E. The capital of West Halmahera Regency is Jailolo, and the distance to the provincial capital in Sofifi is 39 Km. Furthermore, this regency has one regional general hospital and 14 community health centers.

Statistical analysis

The data collected included socio-demographic information and several questions to measure KAP in the questionnaire. Subsequently, the questionnaire consisted of 5 questions about knowledge, 3 statements regarding attitudes, and 5 statements on practices to prevent TB transmission in the family. Knowledge assessment used the Guttman scale, while practices were assessed using a Likert scale.

Knowledge questions were related to preventing transmission incidents and treating TB. Respondents who selected the answer "right" were given a score of 1, and those who answered "wrong" and "don't know" were given a score of 0. Similarly, attitudes measurement also focused on preventing TB transmission and drug resistance. Respondents with an answer of "agree" were given a value of 1, and "disagree" was given a value of 0. Regarding TB prevention practices in the family, successive values were used, namely the answers "always=4", "often =3", "sometimes=2", "seldom= 1", and "never=0". The median value calculation was used as a cut-off to determine the objective criteria for KAP value. The data was analyzed using descriptive statistics and accompanied by narratives to interpret the data.

Ethical aspects

The study was conducted in accordance with the Declaration of Helsinki and approved by the Faculty of Health Sciences, Universitas Muhammadiyah Maluku Utara (No. 94/A/R/XII/2022, December 12, 2022). Informed consent was obtained from all respondents before participation, and all respondents were given an explanation regarding this study and were assured of anonymity and confidentiality.

RESULTS

Respondents included in this study were active TB patients with an average age of 38 years, consisting of 3 and 78 years old, as the youngest and oldest, respectively. The largest age group was found to be 15-24 years old, comprising 35 (23.3%) respondents. Based on gender category, 91 (60.79%) respondents were men. As shown in Table 1, the 15-54-year age group was those in the productive working age, comprising 118 (78.66%) respondents as the largest category of TB patients. 138 (92.0%) respondents had the highest level of education in the low category, while 12 (8.0%) were in the high category. Moreover, the low category is included in the range of basic education to Junior High School, while high education ranges from High School to College.

Among 150 respondents, 115 (76.7%) had permanent jobs and 35 (23.3%) did not work. The most common jobs were farmers, plantation workers, and laborers. The results also showed that 128 (85.3%) respondents had TB drug monitoring status, and 22 (14.7%) did not. Regarding access to obtaining TB drugs, 103 (68.7%) respondents obtained drugs easily, while 47 (31.2%) experienced difficulty. The data presented in Table 1 also showed that 43 (28.7%) respondents had active TB patients in the household, and 11 (7.3%) reported suffering from other diseases.

Table 1. Socio-demographic characteristics of respondents in West Halmahera Regency (n=150).

Characteristics		Frequency	Percentage
Gender	Male	91	60.7
	Female	59	39.3
Age category (years)	<15	5	3.3
	15-24	35	23.3
	25-34	29	19.3
	35-44	28	18.7
	45-54	26	17.3
	55-64	16	10.7
	>65	11	7.3
Education	Low education	138	92.0
	High education	12	8.0
Occupation	Working	115	76.7
	Doesn't work	35	23.3
TB drugs monitoring status	Yes	128	85.3
	No	22	14.7
Other family members suffer from TB	Yes	43	28.7
	No	107	71.3
Suffering from other diseases	Yes	11	7.3
	No	139	92.7
Access to TB drug program	Easy	103	68.7
	Difficult	47	31.2

Regarding the knowledge measurement, 115 (76.6%) respondents were unaware that TB disease could be transmitted through droplets. However, a significant portion (82%) were aware that the duration of treatment for pulmonary TB with the drug was 6-8 months. Additionally, 76.7% of respondents showed awareness that failure to complete treatment could lead to a more severe TB infection. As shown in Table 2, 114 (76.0%) respondents were aware that TB transmission in the family could be prevented by sleeping separately from TB patients. However, 23 (15.3%) were unaware of preventing TB transmission, such as covering the mouth during coughing.

Table 2. Knowledge level about prevention of TB transmission in West Halmahera Regency (n= 150).

Knowledge questions		Frequency	Percentage
Patients with TB can transmit the disease they suffer from through droplets	Right	33	22.0
	Wrong	2	1.3
	Don't know	115	76.7
The regimen/duration of TB treatment using TB	Right	123	82.0

drug is 6-8 months	Wrong	2	1.3
	Don't know	25	16.7
Failure to complete the treatment regimen can lead to more severe TB infection	Right	115	76.7
	Wrong	1	0.7
	Don't know	34	22.6
Prevention of TB transmission can be by sleeping separately with other family members	Right	114	76.0
	Wrong	9	6.0
	Don't know	27	18.0
Prevention of TB transmission can be done by covering the mouth with a hand, cloth, or mask when a TB patient coughs	Right	124	82.7
	Wrong	3	2.0
	Don't know	23	15.3

Table 3 describes the attitudes of 86.7% of TB patients who agreed that transmission easily occurred in the family. Positive attitudes were observed toward the regularity of taking TB medication and awareness, as 84.7% agreed that irregular medication intake could lead to TB drugs. However, 82 (54.7%) respondents disagreed with long-term TB medication.

Table 3. Statement of attitude towards prevention of TB transmission in West Halmahera Regency (n=150).

Attitudes statements		Frequency	Percentage
I agree that TB transmission easily runs in families	Agree	130	86.7
	Disagree	20	13.3
When I do not take TB drugs regularly, I will become resistant to TB drugs later in life	Agree	127	84.7
	Disagree	23	15.3
I agree to take TB medicine regularly even though I have to take it for a long time	Agree	68	45.3
	Disagree	82	54.7

Based on Table 4, only a small percentage of TB patients have practiced preventing transmission by regular treatment or covering the mouth when coughing. This is evident from responses that answered "always".

Table 4. Statements of practice in the prevention of TB transmission in West Halmahera Regency (n=150).

Practice statements		Frequency	Percentage
How often do you take TB medication regularly?	Always	19	12.7
	Often	57	38.0
	Sometimes	44	29.3
	Seldom	21	14.0
	Never	9	6.0
How often do you cover your mouth when coughing?	Always	39	26.0
	Often	47	31.3
	Sometimes	40	26.7
	Seldom	21	14.0
	Never	3	2.0

How often do you visit a health facility to check your health condition?	Always	7	4.7
	Often	47	31.3
	Sometimes	48	32.0
	Seldom	39	26.0
	Never	9	6.0
How often do other family members have their health checked?	Always	8	5.3
	Often	21	14.0
	Sometimes	89	59.3
	Seldom	26	17.3
	Never	6	4.0
How often do you have a disturbing reaction to TB drugs but continue to take medication?	Always	16	10.7
	Often	40	26.7
	Sometimes	29	19.3
	Seldom	18	12.0
	Never	47	31.3

A total of 91 (60.7%) respondents had good knowledge of the prevention of TB transmission, while 59 (39.3%) showed less awareness. Respondents who had good attitudes were 76 (50.7%), while 74 (49.3%) showed poor attitudes. Furthermore, 81 (54.0%) respondents had good practices, while 69 (46.0%) had poor practices (Table 5).

Table 5. Summary of KAP for prevention of TB transmission in West Halmahera Regency (n=150).

Variables	Category	n	%
Knowledge	Good knowledge	91	60.7
	Poor knowledge	59	39.3
Total		150	100
Attitudes	Favorable attitudes	76	50.7
	Unfavorable attitudes	74	49.3
Total		150	100
Practices	Good practices	81	54.0
	Poor practices	69	46.0
Total		150	100

DISCUSSION

This study was conducted to determine the socio-demographic conditions and KAP levels of active TB patients in West Halmahera Regency. The analysis is crucial to obtain valuable data in preparing and evaluating TB eradication programs, serving as a warning against transmission. Good KAP is expected to be a strategy for solving the problem of TB transmission and reducing stigma in treatment [21,22]. However, an obstacle to eradicating TB in Indonesia is the gap in control, partly attributed to delayed initiation of treatment for diagnosed cases. The results of the 2013-2014 TB prevalence survey in the country showed that 43% of the population with TB symptoms did not seek treatment, and 31% sought treatment

independently. This significant discrepancy is attributed to insufficient public knowledge about TB [23]. Moreover, delaying examination and treatment can increase morbidity and mortality [21], hindering the reduction in the number of TB patients.

Based on this study, most TB patients are men (60.7%). In local community tradition, men are often responsible for the family, significantly impacting the family's income. Furthermore, men tend to engage in smoking, which is a risk factor for TB incidence. This is because smoking increases the risk of infection when exposed to *Mycobacterium tuberculosis*, elevating the risk of developing active TB [24,25]. The results also showed that 118 (78.66%) TB patients were of productive or working age. The working age group suffering from an illness can cause low income for their families, affecting the ability to maintain health, education, knowledge, food intake, nutritional status, treatment of diseases, and living conditions. According to previous investigations [26], low income is at risk of suffering from pulmonary TB 4.4 times compared to high income in the working area of Sempor 1 Health Center, Kebumen Regency, Indonesia. Another study reported that approximately 95% of deaths due to TB were in countries with middle and low income [27].

A total of 115 (76.7%) respondents in this study were unaware that TB transmission could be through droplets. Moreover, droplets are splashes of phlegm or sputum released when coughing, sneezing, talking, or even singing, containing *Mycobacterium tuberculosis*, which individuals can inhale in close proximity [13-16]. A previous study [28] also reported that knowledge about TB prevention and transmission in the Equatorial Guinea community was still lacking [28] and in the Saudi Arabian community [29]. Studies in other regions in Indonesia, namely Bulungan Regency and North Kalimantan Province, obtained data on the knowledge of prevention of TB transmission in families of TB patients in the good category [30].

This study measured knowledge of TB prevention, including the correct length of treatment, awareness of the severe impact of treatment failure or drug withdrawal, and preventive measures in family members, such as sleeping separately from patients and covering the mouth during coughing or sneezing. Although the results showed that most respondents are aware of the prevention of TB transmission in the family, the knowledge is still lacking among others, as shown in Table 2. This showed that continuous socialization and education must be provided to both patients and family members.

Global challenges in preventing TB transmission persist across countries, including those with a low incidence rate, such as Oman [31] and Norway [32]. This persistence is attributed to the health behavior of the general population. One of the factors influencing health behavior is good attitudes towards the information received [33]. In this study, attitudes toward the prevention of TB transmission were measured with three statements, as shown in Table 3. The majority of respondents showed positive attitudes toward the prevention of TB transmission.

Meanwhile, in the third statement, namely, the respondent's willingness to take TB medication regularly as a long-term treatment, 82% disagreed. This result should be of concern as irregular and incomplete TB treatment can trigger drug resistance, a significant challenge in global elimination efforts [34]. Similarly, research conducted at a hospital in southwestern Ethiopia reported that attitudes toward preventing TB transmission were almost comparable between patients with favorable and unfavorable attitudes. This shows that individual attitudes are crucial in controlling TB transmission [35]. A report in other regions in Ethiopia also showed that the level of attitudes towards TB prevention was more in the favorable category [36].

TB prevention practices showed a good category among 54% of respondents, as shown in Table 5. Moreover, five statements regarding TB prevention practices, including regular TB treatment and not stopping medication, covering the mouth when coughing or sneezing, and having health checks for all family members regularly, show that only a small percentage of respondents always implement these practices. This percentage is considered insufficient because transmission prevention practices must be carried out strictly due to the threat of resistance to *Mycobacterium tuberculosis*, which can

complicate further treatment [16,37]. Similarly, a previous study in Ethiopia [35,36] showed that TB prevention practices were still low.

The occurrence of drug resistance, specifically MDR-TB, poses a significant challenge to TB treatment and breaking the chain of transmission [34]. MDR-TB is characterized by resistance to at least rifampicin and isoniazid [37-40] due to poor quality of treatment, inappropriate drug dosage, and non-compliance to treatment completion [34,40]. Therefore, TB transmission prevention programs require community participation, determined by good community KAP [30], to facilitate TB elimination. The strategies for increasing KAP for TB prevention and transmission include effective educational programs that provide health education strategies. This consists of delivering basic information about signs/symptoms of TB to individuals or groups, shortening the diagnosis, and delaying treatment to reduce the transmission rate [35].

Furthermore, efforts should be made to implement health education and increase awareness of TB patients about MDR-TB [39]. Based on the gaps identified, this study suggests some recommendations to the concerned authorities. Mecha Regency Health office is recommended to strengthen the awareness creation and health education program towards TB in each healthcare facility. Other responsible stakeholders and NGOs are also recommended to launch awareness sessions about the impact of poor TB practices on the health and the community [36]. Health authorities should intensify efforts and organize specific educational programs about the disease and its impact on the spread of infection in large population sectors. Regarding discovery, treatment should be given special attention by government medical authorities [29], including community-based TB transmission prevention [13].

Studies have proven that TB transmission could occur at the household level and in the community based on fingerprint DNA evidence [8,9,13]. Moreover, with estimates suggesting that one TB patient can infect approximately 10-15 individuals [12], and easy transmission of MDR-TB [41], the provision of early diagnosis is essential for adequate treatment and immediate spread break. Identifying risk factors for TB transmission can also prevent the development of latent TB infection into active disease [41].

CONCLUSIONS

In conclusion, this study showed the ease of TB transmission in the household. The results showed that patients and other family members should be adequately aware of preventive measures. A crucial aspect of this effort was found to be increasing KAP in the prevention of transmission. Furthermore, TB prevention practices included proper monitoring of adherence to medication for adequate recovery through the availability of access to TB drugs. By implementing these measures, the high incidence rate of MDR-TB, a significant challenge faced in TB treatment, could be prevented.

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